



First report of some Trichodinid Ciliophorans (Ciliophora: Peritrichida) (Ciliophora: Trichodinidae) parasitizing cultured Oranda Gold Fish (*Carassius auratus auratus* L.) in India

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General Note



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ABSTRACT

Ornamental fish culture considered as one of the most important means of home entertainment, because of its diversity and beauty of picturesque colors. Trichodiniasis of fishes causing harm and economic losses in this fish industry. There are many records of trichodinids ectoparasites infesting fish have been found throughout the World, but no such study has been conducted on this parasitic group infesting ornamental fish *Carassius auratus auratus* L. in India. During the survey, four already known trichodinid

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species, namely, *Trichodina chittogongensis*, *Trichodina pseudominta*, *Trichodina kaptaiensis* and *Trichodina jialgensis* have been identified to infecting the ornamental goldfish (*Carassius auratus*) for the first time in India. These parasites have not been reported earlier from the Oranda Gold Fish in India. The present paper deals with the taxonomy, systematic and prevalence of the trichodinid ciliophoran species based on the wet silver nitrate impregnation technique and comparisons with closely related species.

Keywords: First Record, Prevalence, Biodiversity, Four species, *Trichodina*, Oranda Goldfish, India

1. INTRODUCTION

Ornamental fish industry is a very important aspect of aquaculture in many countries. It is a very important sector throughout the world (Silva and Turchini, 2008; Jha and Barat, 2005a). Although ornamental fish culture is very popular in India, fish production is conducted by intensive farming with the rudimentary handling of *Carassius auratus*, which is one of the most important pet animal and laboratory fishes in the world (Rylková et al., 2010). These fortunate fishes are severely attacked by trichodinid ciliates causing massive tissue destruction and mortality resulting in heavy financial losses for fish farmer. Ciliates are the most identified ectoparasites where they can easily spread among most of fish hosts (El-Seify et al., 2011a) and trichodinids are the most common ciliate ectoparasites found on the skin and gills of fish. Trichodinids may cause serious damage to the epithelial cells by their constant attachment and also by their movement (El-Tantawy and El-Sherbiny, 2010). It includes those Ciliophorans which possesses complex denticles in the adhesive disc.

Since in India very scanty and infrequent information are available from edible fishes in West Bengal and only five out of nine existing genera under the family Trichodinidae, namely *Trichodina* Ehrenberg (1838), *Paratrichodina* Lom (1963), *Trichodinella* (Raabe, 1950), *Dipartiella* (Raabe, 1959), *Tripartiella* Lom (1959) have so far been reported by various researchers but no studies have been conducted for revealing the parasites of Gold Fish in India.

During the frequent ichthyoparasitological survey of the ectoparasites of Oranda goldfishes (*Carassius auratus auratus*) in India, *Trichodina chittogongensis* Asmat and Mohammad (2005), *Trichodina pseudominta* Tang and Zhao (2013), *Trichodina kaptaiensis* Asmat and Mohammad (2005), *Trichodina jialgensis* Tang and Zhao (2013) have been described from the skin and gills of the fish for the first time in India.

The species have not been reported earlier from goldfish in India. Biodiversity survey of trichodinids ciliophorans in goldfish in India aims to extend our knowledge on the diversity and distribution of this ciliophorans and it is recorded for the first time in the Oranda goldfishes, *Carassius auratus auratus* (L.) collected from few ornamental fish farms of India.

The present paper deals with the taxonomy, systematic and prevalence of the trichodinid ciliophoran species based on the wet silver nitrate impregnation technique and comparisons with closely related species.

2. MATERIALS AND METHODS

Sampling:

During the period of May 2015- June 2016 around 30 fish farms belongings to four districts namely, Nadia, Hooghly, Howrah and North 24-pargana of West Bengal have been surveyed and around 400 fish specimens were collected and brought alive to the Parasitology laboratory and kept in smaller water bodies (vats) in the vicinity of the University.

Parasitological examination:

More than 500 fishes were observed for detection of ectoparasitic infection. Parasitological examination was carried out for the detection and identification of the external parasites on the skin, gills and fin organs of the samples.

Isolation of pathogens:

The infected fishes were collected and examined in every month of the year. Gill, body and tail fin smear were prepared on grease free clean slides with a drop of 0.5% NaCl solution and air-dried. Smears from infested fishes were air dried and impregnated for 10 min in 2 % aqueous AgNO₃ solution (Klein 1958), washed in distilled water, and exposed to ultraviolet light for 20- 25 min, in order to study details of the adhesive disc. Examinations of prepared slides were made under an Olympus CX 41 model (100 X) magnification with an oil immersion lens and photographs were taken with an Olympus CX 41 model. All measurements are in micrometers and follow the uniform specific characteristics as proposed by Lom (1958); Wellborn (1967) and Arthur and Lom (1984).

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In each case, minimum and maximum values are given, followed in parentheses by arithmetic mean and standard deviation. In the case of denticles and radial pins, the mode is given instead of the arithmetic mean. The span of the denticle is measured from the tip of the blade to the tip of the ray. Body diameter is measured as the adhesive disc plus border membrane. The description of denticle elements follows the guidelines of Van As and Basson (1989) was followed for denticle description.

Statistical analysis:

The seasonal prevalence of parasites was calculated according to Bush *et al.* (1997) and Yemmen *et al.* (2010/11).

3. RESULTS

During the present study four species of trichodinids have been observed and isolated from the gills and skin of *Carassius auratus* namely, *Trichodina chittogongensis*, *Trichodina pseudominta*, *Trichodina kaptaiensis* and *Trichodina jialgensis*. Their descriptions are given below.

Table 1

Morphometric measurement and comparison of *T. chittogongensis* with those of Asmat and Mohammad (2005)

Species	<i>Trichodina chittogongensis</i>	<i>Trichodina chittogongensis</i>
Host	<i>Carassius auratus auratus</i>	<i>Labeo bata</i>
Locality	Haringhata West Bengal, India	Karnaphuli River, Bangladesh
Site of Infection	Gills	Gills
Reference	Present study	Asmat and Mohammad (2005)
Diameter of Body	35.5-45.59 (40.11±1.79)	36.7-45.9 (40.6±2.7)
Adhesive disc	28.3-35.5 (30.08±2.5)	29.6-37.7 (33.0±2.5)
Dimension of body		
Denticular ring	19.5-24.5 (21±1.77)	19.4-24.5 (21.7±1.3)
Central area	6.5-11.5 (7.82±1.99)	6.6-12.2 (9.2±1.3)
Width of broader membrane	2.5-3.5 (2.78±0.33)	2.5-4.1 (3.8±0.5)
Number of denticles	22-24 (22.77±0.97)	22-24 (22.9±0.8)
Number of radial pins/Denticle	5-8 (6.41±1.37)	5-8 (6.6±0.8)
Dimension of denticle		
Span	9.5-13.5 (10.78±1.88)	9.7-13.3 (11.2±1.0)
Length	5.5-6.1 (5.77±0.25)	5.1-6.1 (5.2±0.2)
Dimension of denticle components		
Length of ray	3.0-4.5 (3.75±0.63)	3.1-5.2 (4.0±0.5)
Length of blade	4.5-5.9 (4.96±0.54)	4.1-6.1 (5.1±0.7)
Width of central part	2.0-2.5 (2.21±0.2)	2.0-2.5 (2.1±0.2)

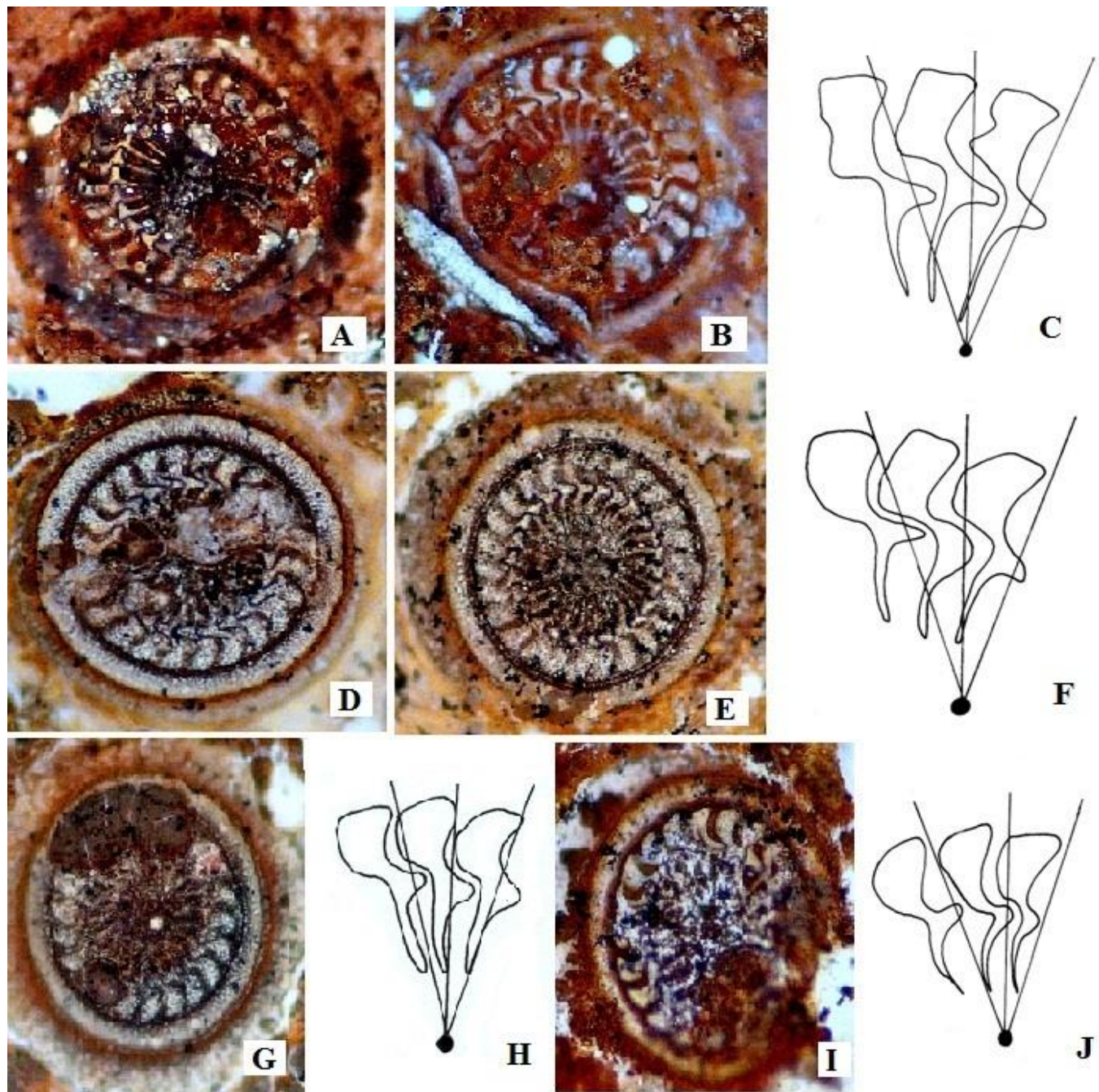


Figure (A-J)

Photomicrographs of Trichodinid species. (A-B) showing silver nitrate impregnated adhesive discs and (C) showing diagrammatic drawings of the denticles of *Trichodina chittogongensis*. (D-E) showing silver nitrate impregnated adhesive discs and (F) showing diagrammatic drawings of the denticles of *Trichodina pseudominta*. (G) showing silver nitrate impregnated adhesive discs and (H) showing diagrammatic drawings of the denticles of *Trichodina kaptaiensis* and (I) showing silver nitrate impregnated adhesive discs and (J) showing diagrammatic drawings of the denticles of *Trichodina jialgensis*.

Trichodina chittogongensis (Fig A-C, Table 1)

Description:

Small disc-shaped body having a diameter of 35.5-45.59 (40.11 ± 1.79) μm . The adhesive disc measures 28.3-35.5 (30.08 ± 2.5) μm in diameter, surrounded by a border membrane 2.5-3.5 (2.78 ± 0.33) in width. Diameter of denticular ring is 19.5-24.5 (21 ± 1.77) μm and having 22-24 (22.77 ± 0.97) numbers of denticles 5-8 (6.41 ± 1.37) of radial pins per denticle. Rounded denticle blades relatively small with a well identified ray apophysis (Fig. A, B). Dimension of denticle is 9.5-13.5 (10.78 ± 1.88) μm \times 5.5-6.1 (5.77 ± 0.25) μm . Denticle rays are often wider at their distal ends having a diameter of 3.0-4.5 (3.75 ± 0.63). Central part measuring 2.0-2.5 (2.21 ± 0.2), finely developed and well notched into preceding denticle that extending almost full area of y-1 axis (Fig. C). Length of blade is 4.5-5.9 (4.96 ± 0.54) μm .

Taxonomic summary:

Host: *Carassius auratus auratus* (L.)

Fish Family: Cyprinidae

Locality: Haringhata, Nadia, West Bengal, India ($22^{\circ}53'N$ - $24^{\circ}11'N$ / $88^{\circ}09'E$ - $88^{\circ}48'E$)

Location: Gills

Prevalence: 26.95%

Reference material: Lectotype, slide OF/KU/ZOOL/2015-111 have been deposited in the parasitology laboratory, Department of Zoology, University of Kalyani

On analyzing the morphometric and quantitative data of the present specimen, it was readily identified as *Trichodina chittogongensis* which morphometrically shows exact similarities compared with Asmat et. al. (2005) in Table 1.

Trichodina pseudominta (Fig D-F, Table-2)

Description:

Medium disc-shaped body having a diameter of 45.1-52.5 (48.76 ± 2.93) μm . The adhesive disc measures 32.5-40.9 (34.53 ± 1.87) μm in diameter has a clear central zone, surrounded by a finely striated border membrane 3.5-5.6 (4.42 ± 0.85) μm in width. Diameter of denticular ring measures 18.5-22.5 (19.67 ± 1.31) μm and. Numbers of denticles is 20-23 (20.71 ± 1.25) having s 7-8 (7.53 ± 0.51) number of radial pin per denticle. The denticle spans .5-15.5 (11.8 ± 2.51) μm and the length of the denticle is 5.5.0-7.8 (6.59 ± 1.03). The blade length is 4.5-7.1 (6.08 ± 1.03). The distal blade surface is smooth and round, parallel to border membrane, and is higher than the bluntly round tangent point (Fig. D, E). The anterior surface extends past the Y+1 axis and the posterior surface forms an arc-shape with deep point. Apophysis of the blade and posterior projection is absent. The shape of the central part above and below the X-axis is nearly the same, measures 2.5-3.9 ($3.05.5 \pm 0.42$) (Fig. F). The ray connection is inconspicuous and is obliquely attached with sharp point measures 4.5-6.5 (5.45 ± 0.74). The ray apophysis is not obvious or absent in some specimens.

Taxonomic summary:

Host: *Carassius auratus auratus* (L.)

Fish Family: Cyprinidae

Locality: Howrah, West Bengal, India ($22^{\circ}35'N$, $88^{\circ}19'E$)

Location: Gills

Prevalence: 32.2%

Reference material: Lectotype, slide OF/KU/ZOOL/2015-112 have been deposited in the parasitology laboratory, Department of Zoology, University of Kalyani.

Considering all the morphometric and quantitative data, the present specimen was clearly identified as *Trichodina pseudominta* which compared with its original description provided by Tang and Zhao in Table 2.

Table 2

Morphometric comparison of *Trichodina pseudominta* obtained in the present study with those of Tang and Zhao (2013).

Species	<i>Trichodina pseudominta</i>	<i>Trichodina pseudominta</i>
Host	<i>Carassius auratus auratus</i>	<i>Carassius auratus</i>
Locality	Howrah, West Bengal, India	Chongqing, China
Site of Infection	Gills	Gills
Reference	Present study	Tang and Zhao (2013)
Diameter of Body	45.1-52.5 (48.76±2.93)	41.0 - 51.5(44.6 ± 3.9)
Adhesive disc	32.5-40.9 (34.53±1.87)	32.5 - 41.5 (35.9 ± 3.6)
Dimension of body		
Denticular ring	18.5-22.5 (19.67±1.31)	18.0 - 23.0(20.3 ± 1.9)
Central area	9.5-11.9 (10.56±0.93)	10.5- 16.5(11.29 ± 1.8)
Width of broader membrane	3.5-5.6 (4.42±0.85)	3.5 - 5.5(4.5 ± 0.6)
Number of denticles		20 – 23
	20-23 (20.71±1.25)	
Number of radial pins/Denticle		7 - 8
	7-8 (7.53±0.51)	
Dimension of denticle		
Span	10.5-15.5 (11.8±2.51)	10.5- 16.5 (112.9 ± 1.8)
Length	5.5.0-7.8 (6.59±1.03)	5.0 - 7.5 µm (6.0 ± 0.8)
Dimension of denticle components		
Length of ray	4.5-6.5 (5.45±0.74)	4.0 - 6.5 µm (5.0 ± 0.7)
Length of blade	4.5-7.1 (6.08±1.03)	4.5 - 7.5 µm (5.8 ± 0.7)
Width of central part	2.5-3.9 (3.05.5±0.42)	2.0 - 4.0(2.8 ± 0.5)

Trichodina kaptaiensis (Fig I-J, Table 3)

Description:

Medium flattened body having a diameter of 45.5-49.5 (46.7±1.03) µm. The adhesive disc measures 36.2-41.6 (38.12±2.24) µm in diameter, surrounded by a wide border membrane 4.6-5.0 (4.74±0.19) µm in width. Diameter of denticular ring is 21.4-27.9 (23.15±2.56) µm consists of 20-22 (21±1.06) numbers of denticles with 8-9 (8.5±0.53) radial pins each. Blade of denticle broad, filling most of space between y+1 axes (Fig. J). Dimension of denticle measures 11.5-13.0 (12.36±0.60) µm × 4.5-5.5 (4.97±0.43) µm. Central part broadly triangular with rounded tips, measures 2.5-3.5 (2.97±0.41). Length of ray is 4.5-5.5 (5.08±0.40) µm and length of blade is 3.8-4.1 (3.96±0.15) µm.

Taxonomic summary:

Host: *Carassius auratus auratus* (L.)

Fish Family: Cyprinidae

Locality: Haringhata, Nadia, West Bengal, India (22°53'N-24°11'N/88°09'E-88°48'E)

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Location: Gills

Prevalence: 18.6%

Reference material: Lectotype, slide OF/KU/ZOOL/2015-117 have been deposited in the parasitology laboratory, Department of Zoology, University of Kalyani

Trichodina jialgensis obtained in the present study is morphometrically compared with Tang and Zhao (2013) showing little variation in measurement in Table 3.

Table 3

Morphometric comparisons of *Trichodina kaptaiensis* obtained in the present study with those of Asmat and Mohammad (2005)

Species	<i>Trichodina kaptaiensis</i>	<i>Trichodina kaptaiensis</i>
Host	<i>Carassius auratus auratus</i>	<i>Chanda nama</i>
Locality	Haringhata, West Bengal, India	Kaptai Lake
Site of Infection	Gills	Gills
Reference	Present study	Asmat and Mohammad (2005)
Diameter of Body	45.5-49.5 (46.7±1.03)	45.4-49.6 (47.5±2.2)
Adhesive disc	36.2-41.6 (38.12±2.24)	35.2-42.8 (37.6±2.3)
Dimension of body		
Denticular ring	21.4-27.9 (23.15±2.56)	21.4-28.6 (24.0±2.2)
Central area	8.5-14.1 (10.66±2.62)	8.2-15.3 (10.1±2.5)
Width of broader membrane	4.6-5.0 (4.74±0.19)	4.6-5.1 (4.9 ± 0.2)
Number of denticles	20-22 (21±1.06)	20-22 (21.0 ± 0.8)
Number of radial pins/Denticle	8-9 (8.5±0.53)	8-10 (8.9 ± 0.9)
Dimension of denticle		
Span	11.5-13.0 (12.36±0.60)	11.2-13.2 (12.5±0.6)
Length	4.5-5.5 (4.97±0.43)	4.1-6.1 (4.9±0.7)
Dimension of denticle components		
Length of ray	4.5-5.5 (5.08±0.40)	4.6-5.6 (5.3±0.3)
Length of blade	3.8-4.1 (3.96±0.15)	3.6-4.6 (4.3±0.3)
Width of central part	2.5-3.5 (2.97±0.41)	2.5-3.6 (3.1±0.4)

Trichodina jialgensis (Fig G-H, Table 4)

Description:

Large sized specimen having a diameter of 45.5-52.3 (47.44±2.34) µm. The adhesive disc measures 33.5-44.0 (38.51±2.13) µm in diameter. Border membrane is slightly wide having a diameter of 3.5-4.5 (3.77±0.34) µm in width. Diameter of denticular ring is 16.0-26.5 (18.27±4.04) µm having 22-25 (23.37±1.30) numbers of denticles consists of 7-8 (7.3±0.48) radial pins each. The distal blade surface is smooth having is 4.2-5.5 (4.74±0.50) µm in length but not parallel to border membrane. The anterior and posterior surfaces are approximately parallel to each other. The anterior surface not touching the Y+1 axis. Span of denticle is 10.5-12.5 (11.24±0.81) µm in width and length of denticle is 5.5-6.5 (5.83±0.38) µm. Central part of denticle is not fully developed with the rounded point

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fitting into the preceding denticle, and extending almost half way to the Y-1 axis (Fig. H). The width of central part measuring 1.5-2.5 (1.81 ± 0.41) μm in diameter. Well developed ray are not oblique to the Y-axis and having 3.5-5.2 (4.21 ± 0.68) μm in length.

Taxonomic summary:

Host: *Carassius auratus auratus* (L.)

Fish Family: Cyprinidae

Locality: Haringhata, Nadia, West Bengal, India ($22^{\circ}53'N-24^{\circ}11'N/88^{\circ}09'E-88^{\circ}48'E$)

Location: Gills

Prevalence: 9.1%

Reference material: Lectotype, slide OF/KU/ZOOL/2015-114/116/117 have been deposited in the parasitology laboratory, Department of Zoology, University of Kalyani.

Considering all the above aspects, present specimen are seems to be identified as *Trichodina kaptaiensis* which morphometrically confirmed its identity in comparison to its original description provided by Asmat et. al. (2005) in Table 4.

Table 4

Morphometric comparisons of *Trichodina jialgensis* obtained in the present study with those of Tang and Zhao (2013)

Species	<i>Trichodina jialgensis</i>	<i>Trichodina jialgensis</i>
Host	<i>Carassius auratus auratus</i>	<i>Ctenopharyngodon idellus</i>
Locality	Haringhata, West Bengal, India	Chongqing, China
Site of Infection	Gills	Gills
Reference	Present study	Tang and Zhao (2013)
Diameter of Body	45.5-52.3 (47.44 ± 2.34)	41.0 - 52.0 (47.6 ± 3.2)
Adhesive disc	33.5-44.0 (38.51 ± 2.13)	33.0 - 44.0 (39.1 ± 3.2)
Dimension of body		16.0 - 27.5 (23.3 ± 3.3)
Denticular ring	16.0-26.5 (18.27 ± 4.04)	-
Central area	7.9-12.5 (9.2 ± 1.83)	3.5 - 5.0 (4.5 ± 0.5)
Width of broader membrane	3.5-4.5 (3.77 ± 0.34)	
Number of denticles	22-25 (23.37 ± 1.30)	22 - 25
Number of radial pins/Denticle	7-8 (7.3 ± 0.48)	7 - 8
Dimension of denticle		
Span	10.5-12.5 (11.24 ± 0.81)	10.5 - 13.0 (11.7 ± 0.6)
Length	5.5-6.5 (5.83 ± 0.38)	5.0 - 6.5 (5.8 ± 0.5)
Dimension of denticle components		
Length of ray	3.5-5.2 (4.21 ± 0.68)	3.5 - 5.5 (4.6 ± 0.6)
Length of blade	4.2-5.5 (4.74 ± 0.50)	4.0 - 5.5 (5.1 ± 0.5)
Width of central part	1.5-2.5 (1.81 ± 0.41)	1.5 - 3.0 (2.3 ± 0.4).

4. DISCUSSION

Up to date more than 250 species of the genus *Trichodina* have been reported from various corners of the world. The reports on the occurrence of known trichodinid species in India are much less numerous than expected. Only few previously known trichodinids have so far been reported from India by many workers (Mukherjee and Haldar, 1982; Asmat, 2002a; Mishra and Das, 1993; Asmat, 2000b; Mitra et. al., 2013). A list of only four known species of the trichodinid ciliophorans namely, *Trichodina chittogongensis*, *Trichodina pseudominta*, *Trichodina kaptaiensis* and *Trichodina jialgensis* recovered for the first time in this study from the gills and skin of *Carassius auratus auratus* (L.) from a biodiversity hot spot country like India which is obviously far from complete.

Trichodina chittogongensis and *Trichodina kaptaiensis* were firstly established by Asmat and Mohammad (2005). The present observations on *Carassius* sp. are in conformity with the original description except some variations in the size of the body and the adhesive disc with blade length. Present specimens are slightly larger in size in comparison to its original one. Earlier, this parasite was recorded from the gill filaments of *Labeo bata* in Bangladesh. The findings revealed that *T. chittogongensis* also prefers ornamental fish as its host and established as a new host for the parasite which forward new light on the biodiversity and host preference of the species. Hence it is the first record of the species in India from *Carassius* spp.

Trichodina pseudominta and *Trichodina jialgensis* were firstly established by Tang and Zhao (2013) from the gills of *Carassius auratus* in China. It has not been reported from India. Our study has supplemented the work on biodiversity and host preference of the ciliate species and also a new distribution in Asia sub continent for this species.

5. CONCLUSION

Up to date more than 230 species of the genus *Trichodina* have been reported from various corners of the world. In India, the emphasis has always been on describing new species, and as a result 12 new species belonging to the genus *Trichodina* have been described so far. Interestingly, the reports on the occurrence of known trichodinid species in India are much less numerous than could be expected. Only few previously known trichodinids have so far been reported from India. The present investigation extends this area to include the *Carassius auratus auratus* (L.) is added to the list of hosts. This communication deals with the extension of our knowledge on the biodiversity and distribution of these ciliophorans though these ciliates have been first time recorded form India.

SUMMARY OF RESEARCH

Background: Ornamental fish culture considered as one of the most important means of home entertainment, because of its diversity and beauty of picturesque colors. Trichodiniasis of fishes causing harm and economic losses in this fish industry through mortality and decrease growth rate. **Aims:** The paper deals with the diversity, distribution and taxonomic descriptions of these six Trichodinid species based on the wet silver nitrate impregnated observations along with new host, locality records and prevalence rates and it happens to be the first report from Oranda Goldfishes in India. **Settings and Design:** A comprehensive ichthyoparasitological survey in some ornamental fish farms of India. **Material and Methods:** Silver nitrate impregnated parasites are snapped by an Olympus CX 41 model (100 X) **Statistical analysis Used:** For calculation of prevalence, mean intensity and abundance, the statistical formula has been followed. **Results:** A comprehensive ichthyoparasitological survey in some ornamental fish farms of India has been revealed the occurrence of four previously described Trichodinid species identified from the skin and gills of *Carassius auratus auratus* for the first time in India. They are *Trichodina chittogongensis*, *Trichodina pseudominta*, *Trichodina kaptaiensis* and *Trichodina jialgensis*. **Conclusion:** There are many records of different species of trichodinids ectoparasites infesting cultured ornamental fish have been found from all over the World, but no such study has been conducted on this parasitic group infesting on ornamental fish most preferably in Oranda Gold Fish in India. These parasites have not been reported earlier from the Oranda Gold Fish of India.

FUTURE ISSUES

We believe that furthermore investigation should be carried out in India to explore the possibilities of both new and previously described trichodinid species and stress would be given to identify those ciliophorans by molecular characterization using advanced technologies.

DISCLOSURE STATEMENT

There is no disclosure statement.

ACKNOWLEDGMENT

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